

MOTOR SUGGESTION IN CHILDREN

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THE term suggestion has been used to cover such a wide variety of phenomena that it is necessary to define carefully the type under consideration and differentiate it from the other uses of the term. A rough classification of the various definitions may be made under the three headings of sensory, ideational, and motor suggestion. Sensory suggestion seems to mean merely illusions of sensation occurring under some special condition of expectancy, emotion, or the like. Ideational suggestion is clearly stated in MacDougall's (23) classic definition, "Suggestion is a process of communication resulting in the acceptance with conviction of the communicated proposition in the absence of logically adequate grounds for its acceptance."

Motor suggestion, the type with which this study deals, is more difficult to define concisely. Baudouin (2) characterizes it as "the automatic activation of an idea;" Hilger (12) as "the dynamic nature of ideas." Morgan (24) makes the statement that "every idea of an action will result in that action unless hindered by a competing idea or physical impediment." Hartenburg (11) names this active suggestion or "the excessive impulsiveness of ideas."

Some writers, among them MacDougall (23), do not call this suggestion at all, but class it as simple

ideo-motor activity, or unconscious imitation. Dunlap (8) objects to this terminology and substitutes the phrase "similitude reactions" which are "sometimes said to be unconscious imitations, but such is not really the case. They are not reflective it is true; they are unintentional; but there is perceptual consciousness involved in each one of them." Ladd and Woodworth (17) deal with the question of the unconscious nature of the phenomenon in a clear and objective way: "Certain ideas lead to certain definite movements with which they have become associated by past experience. They may do so either with or without the full consent of the subject. When an idea leads to its appropriate movement with the full consent of the subject, we call it voluntary movement, but when the idea leads to movement, as it always tends to, while the subject's attention and intention are elsewhere directed, the movement is often named ideo-motor." There is thus a graduated scale from wholly conscious purposive imitation to, at the other extreme, the involuntary carrying out of a suggestion of which one is more or less unconscious, acting as an automaton. This might equally as well be called involuntary imitation or any one of the other dozen names which have been applied to it.

The definition of Ladd and Wood-

worth (17) contains an adequate theoretical explanation. Ideo-motor activity is a specialized type of habit formation in which the act is more or less involuntary and outside the focus of attention. Humphrey (13) upholds the same view, though he interprets imitation in terms of the conditioned reflex, saying it "may be defined as action involving a conditioned reflex the secondary stimulus of which is similar to the reaction." He adds that these relatively elementary and unconscious units of imitation form a part of a larger and undoubtedly conscious system. It is the isolation and measurement of such simple elements of action in the young child that this study aims to achieve.

PREVIOUS EXPERIMENTS WITH ADULTS

The bulk of experimental work dealing with suggestion has been carried on with adult subjects. A large part of this treats only sensory and ideational suggestion, which do not concern us here. The first study of motor suggestion was Jastrow's (14) experiment in 1892. He devised an automograph to record the involuntary motion of the hand and head. His results show movement toward the object of attention and oscillation with the beat of the metronome or pendulum. Solomon and Stein (32) used a planchette whose action was similar to that of the automograph. They found a general tendency to involuntary movement as soon as the attention of the subject was removed. They were able to develop a high degree of proficiency in automatic writing, which they explain as the unconscious passage of sensation into motor reactions.

Pearce (27) investigated the motor response to dermal, auditory, and visual stimuli, asking the subject to localize a stimulus, at the same time giving a second one near the spot where the first had been. It was found that this second stimulus or suggestion caused an error in localization varying with its intensity and distance from the first.

Brand (6) studied the effect of verbal suggestion upon the estimation of linear magnitudes, concluding that purely formal and arbitrary suggestion produces a definite though slight effect. Smith and Sowton (31) report the same results. Bell's (3) work was similar, showing the effect of suggestion on the reproduction of triangles and point distances. Both auditory and visual suggestions were used. There were decided individual differences in susceptibility to suggestion. Jones (16) found that suggestions of ability and inability also influenced reproduction of distances. Variability and error were less with affirmative than with negative suggestion, but least of all with no suggestion.

Strong's (34) work dealt with the effect of suggestion on muscular activity measured by the dynamometer. He found that suggestion as a whole heightens the maxima above neutral, the negative more so with some subjects and the positive with others. In comparing his results with those of Jones, Strong points out that suggestion hinders when accurate work is to be done, but helps when mere amount of muscular effort is wanted.

Starch (33) in his study of unconscious imitation of handwriting, 1911, was the first to use a large group of

subjects. One hundred and six students wrote words and sentences from copies of different kinds of handwritten and typed material. Three of the subjects purposively imitated the copy. Their results were discarded. All of the remaining 103 subjects showed a change in size and slant of their writing in accordance with the type of material copied. The men showed a greater tendency towards imitation than the women.

Langfeld (18) has studied the effect of positive and negative instructions on voluntary movement. The negative method is supposed to be a suggestion towards poorer work. He used a tracing board with both types of instructions. In general his results show that the best work is done with positive instructions, though great variability exists.

PREVIOUS EXPERIMENTS WITH CHILDREN

The experimental work dealing with child subjects falls naturally into two chronological divisions. Binet (5, 6) and the other workers at the beginning of the century were chiefly concerned with devising tests to measure the trait called suggestibility, and applying them to children in the hope of finding individual and age differences. Since 1920, however, the trend has been away from individual measures towards the use of a battery of tests in attacking some specific problem, either theoretical or practical, in the field of suggestion.

Practically all of the earlier tests dealt with sensory and ideational suggestion. Otis (26) has summarized a number of these. Most of the results

agree in indicating an inverse relationship between age and suggestibility as measured by this type of test.

Very few tests of motor suggestion have been applied to children. Jastrow (14) in his original work with the automatograph used one child subject, a boy of eleven who showed extensive and coarse movement. With the same apparatus Tucker (36) made a comparison of the involuntary movements of 18 adults and 25 children. He found no definite tendency to move toward a seen object if it was thought of as at rest. A moving stimulus produced imitative movements in the direction of its motion. Children were subject to these laws to a less degree than adults. No sex or age differences among them were discernable.

Binet (4) contributed several ingenious tests of motor suggestion. Two he classed as experiments on subconscious movements. The child passively held one end of a balance which the examiner moved in rhythm with the beats of a metronome. This movement was gradually discontinued and in many cases the child would carry it on automatically. In a similar manner Binet attempted to produce automatic writing. He remarks that these automatisms do not appear to coincide with automatisms of judgment. Simon (30) repeated the tests on abnormal children using a pendulum. Giroud (10) used Binet's methods but gives no results. A second type of motor suggestion is tested by Binet as "submissive imitation." The children are studied in groups to find the extent to which they will imitate the words and drawings of others. Binet also describes several types of automatisms

which he investigated but did not develop as tests because they revealed little in the way of individual differences. One of these was similar to a method used with preschool children in this study. Subjects were asked to make a circle exactly three centimeters away from one which was drawn on a sheet of paper. The tendency to make the second equal in size to the first was almost universal.

In more recent years tests of motor suggestion have been developed by various authors and used in batteries for the investigation of some specific problem. Sherman (29) reports 2 in her study of the relative suggestibility of normal and mentally defective children. One showed the effect of pointing arrows in tracing a path, the other the effect of pointing hands upon choice. The results indicate that "both normal and mentally defective children were suggestible in all of the tests used, and that in both groups of subjects suggestibility was related to their development."

Aveling and Hargreaves (1) conducted a series of tests to study the effect of personal prestige on suggestion. Five of the tests dealt with sensory and ideational suggestion and are described in Whipple's manual (38). In addition there were 2 tests of their own invention, Hand Rigidity and Hand Levitation. In these the experimenter used verbal instructions to induce an affect of rigidity or of lightness in the hand of the subject. These last two tests, together with the illusion of warmth test and line lengths by personal influence, were situations in which personal prestige was the most conspicuous element. In the three

other tests the personal factor was at a minimum and suggestion was of the "non-prestige type." It was found that the frequency distributions of scores varied in accordance with the type of test. Those tests in which the prestige factor was low gave a normal distribution, showing that all subjects were suggestible in varying degrees. Those in which the personal factor was dominant presented a "U" type of curve, owing to the development of contra-suggestibility in a number of cases.

Estabrooks (9) interpreted the results of Aveling and Hargreaves (1) in terms of emotion. He believes that the "U" type of curve in prestige tests is the result of the "All or none" principle which responses tend to follow when accompanied by strong feeling tone. If such be the case, suggestibility in this type of test should correlate closely with the psycho-galvanic reflex. To demonstrate this proposition he conducted an investigation on boys whose mean age was 11.5 months. The psycho-galvanic reflex and three tests of suggestibility were used, illusion of an electric shock, material-weight illusion, and a "Bob Test." This was a modified Chevreul's Pendulum. An iron bob on an 18-inch string, which the child held, was hung in a glass tumbler. Suggestions as to its movement were given and the time recorded until it swung enough to touch the side of the glass. This Bob Test and the electricity test were designed to include a strong factor of emotion. The distribution curve of results is of the "U" type. In the material-weight illusion personal influence was eliminated as much as possible. Here a

typical curve of normal distribution resulted. Correlation between the tests and with the psycho-galvanic reflex were negligible. Estabrooks concludes that "in tests for suggestibility we do tend to get the "All or nothing" type of response when strong emotion is concerned, and that the resultant U-curve tends to become normal as this emotional element recedes. This is especially so if it is superceded by an element of intellectual discrimination." He believes that this non-prestige type of reaction should be called "illusibility" rather than suggestibility.

This analysis of the experiments on motor suggestion with child subjects shows that practically no work goes below the level of six years. The only exception is Mosse's (25) investigation of the therapeutic value of suggestion on 22 children from three to six years of age. He gave them a fake medicine with the suggestion that it would produce immediate urination. In all of the cases the suggestion was effective.

To find material using subjects below school age it is necessary to look to studies of contrary suggestion or negativism. According to MacDougall (22) this converse of suggestibility results when unpleasantness has been connected with the stimulus in the past. Bridges (7) says it is a defense reaction against hyper-suggestibility. If this be true, measures of resistance will be valuable as indications of suggestibility.

Levy and Tulchin (19, 20, 21) made an extensive study of the resistance of infants and children during mental tests. Nine hundred and eighty-three subjects were grouped according to the amount of resistance shown, the crite-

riion being refusal to take the tests. The results show a gradual rise from a low level of resistance at six months to a high point at thirty to thirty-six months, then a rapid fall to a low limit from forty-eight to fifty-four months. Nelson, in a report edited by Thomas (35), presents the results of another study of resistance in the mental test situation. The Merrill-Palmer Performance and Kuhlman-Binet tests were given to 28 children whose chronological ages were from eighteen to forty-eight months and mental ages from thirty to seventy-two months. Though the number of cases is small the results point to a definite decrease of negativism with increasing chronological age, mental age, and intelligence quotient.

Reynold's (28) study of negativism bears this out. She used 229 children from twenty-one to sixteen months in age, placing them in 13 successive situations where negativistic behavior might be manifested and giving a score of one for each instance where it appeared. Her results show that negativism wanes consistently with age.

PRELIMINARY EXPERIMENTATION

The historical summary makes it clear that very little work of the type classed as motor suggestion has been done on children, especially those of preschool age. This made it necessary to devise tests which would measure this trait, the involuntary translation of a perception into bodily activity.

There were certain conditions which such a test had to fulfill. In the first place the reaction required of the child had to be of such a simple nature that it would be well within the power of a

three year old child to perform, and preferably within the ability of a two year old. If the tests were too difficult, the variations in motor ability among the children would entirely obscure the effects of suggestion. In the second place, the attention of the child had to be distracted as much as possible from the suggestion so that purposeful imitation would be eliminated. Nor should submission to the personality of the experimenter play an undue part. Finally the test must be one to hold the interest of the child.

The 8 experiments which were devised met these conditions more or less successfully. Each was given to a small group of subjects to test its applicability to the problem. All except the last two were found to be unsatisfactory as measures of the trait under consideration and so were not continued in the major study. A brief report of each is given to show the evolution of the technique finally adopted.

1. *Tracing path*

In her study of motor coordination Wellman (37) makes the statement, based on Langfeld's work, (18) that positive instructions will result in greater success than negative. This seemed to be a clear-cut case of the idea of an action producing that action whether the subject wills it or no. To test this assumption the tracing path test used by Wellman was given to 43 children between the ages of 2:7 and 6:3 years, under the two types of instructions. (Throughout this study age will be so designated in years and months. Thus 2:7 means two years and seven months.) Eighteen of the children took the test 4 times, twice

under the positive and twice under negative instructions. Twenty-five took it twice, once with each type of procedure. At least a week's time intervened between each test. The order of giving the 2 kinds of instructions was varied with the different subjects so as to minimize the effects of practice. The 2 types of procedure were as follows:

Positive instructions. The child was seated at a table of comfortable height. Before him was placed a sheet of paper on which had been drawn two "tracing paths" (37). These are 2 straight lines 25 cm. in length 5 cm. apart at one end and 1 cm. apart at the other. The sheet was tacked to a card board and so placed that the wider end of the path was at the child's left, making the line to be drawn from left to right. The experimenter picked up a red pencil saying, "See this pencil? I want you to make a mark right down the path with the pencil. Keep right in the middle of the path all the time. Make it look just like this, a nice straight line." The child was then shown a sample perfectly drawn with a red line down the exact center of the path. When he had completed the line the sheet of paper was turned around so the other path was next to him. Its larger end was at the child's right so that the line had to be drawn from right to left. The instructions were repeated as before.

Negative instructions. This procedure was similar to that above except that instead of showing the child a perfect sample the experimenter showed one very poorly done, pointing out the errors with the words, "Don't touch the sides like this or make a wiggly line like this."

Two methods of scoring were tried. The first score was that part of the guide line, measured in centimeters, where the line that the child had drawn was outside the path. The second method was to measure the total length of the child's line with a map measurer, the score being the length in excess of 25 cm. Neither of these methods proved fine enough to discriminate the effect of suggestion if such existed. The difference between the kind of line drawn under positive and under negative instructions was no greater than the difference between the 2 lines drawn with the same instructions.

2. Coördination test

As a check on the effect of positive and negative instructions, the Johnson form of the Johns Hopkins series of coördination tests (15) was used with the same procedure as the tracing path described above, to the same 43 children. The score consisted of the number of errors, that is, the number of times the child's line touched the side of the path. The results were the exact reverse of what was expected. The average number of errors per sheet was 6.3 under positive instructions, and 3.4 under negative.

3. Ladder experiment

This experiment was an attempt to measure the child's tendency towards involuntary imitation in drawing. Twenty children from 3:6 to 5:4 years of age were tested in groups of five and six. Each child was seated at a separate table and given a sheet of drawing paper on which had been drawn with black crayon 2 parallel vertical lines 20 cm. long and 8 cm.

apart. The experimenter had a similar sheet on an easel where it could be plainly seen by the group. She called their attention to it by saying, "Do you see these 2 lines on my paper just like the 2 lines on your paper? I'm going to make a ladder out of these 2 lines by drawing lines straight across. Watch me (drawing). Now you make ladders with these crayons." The children were then given black crayons and the sample left in view while they were drawing. Three methods of drawing the sample were used, making the rungs of the ladder straight across, that is horizontal, or making them slope to the right or to the left so that one edge of each rung was 2 cm. below the other. The test was repeated three times, a week apart, once with each type of suggestion. The results were not significant. Only 6 out of the 20 children accepted the suggestion, that is, made the slope of their rungs pronounced enough to show that it was not the result of chance error.

4. Drawing pictures

This test was similar to the preceding one, but the suggestion was more obvious. The same 20 children were tested in groups as before. Each was given a sheet of paper and 3 colored crayons of his own choice. The experimenter then said, "When I say 'begin' we are all going to draw pictures. You can make any kind of a picture you want to." One of three variations in procedure followed. In one a picture of a flower was shown with the words, "You can make a flower like this if you want to. Look at this flower, with its yellow center and

colored leaves (pointing at the parts and being sure all the children attend). Or you can make anything else you like." In the second type of procedure no picture was shown but the verbal suggestion was given, "You can make a tree if you want, a nice big tree." In the third no suggestion was given.

The individual results were interesting, but quantitatively they have little value because of the small number of subjects. Of the 20 children 5 accepted the suggestion of drawing the tree, 5 of drawing the flower. This test was discarded because it gave only the number of times the suggestion was accepted and not the extent of the acceptance. There were also various sources of error which resulted from the group administration of the test.

5. Running to get ball

This experiment was designed to show the effect of suggestion on the gross bodily activity of the child. The child was placed behind a low gate at one end of an alley 12 feet long and 2 feet wide. At the other end was a low table with a ball on it, well illumined by a drop light. Three types of procedure were used. That with no suggestion was given first. The child was told to go get the ball, the gate was opened, and the time taken to reach the table was recorded. A week later the experiment was repeated with either fast or slow suggestion. The former consisted of the experimenter first demonstrating by running quickly down the alley to get the ball. In giving the slow suggestion she walked very deliberately to the ball. These procedures were alternated for four

successive weeks. Finally on the sixth trial as on the first no suggestion was given.

Twenty-nine children from 2:1 to 4:9 years of age were given the test. In two or three individual cases the suggestion seemed to have an effect in slowing down or speeding up the running. But the average time for the group showed no effect of suggestion. There were several sources of error which may account for these negative results. In the first place the suggestion given was not always attended to carefully. The children were distracted by various things, especially the hinge on the gate which they enjoyed manipulating. The timing was not accurate enough for such a short running path. If it had been several times longer the results might have been more satisfactory.

6. Punching, Form A

This experiment was also designed to test the effect of suggestion on speed of movement. A very simple manual process was chosen, that of punching holes in paper. The child was seated at a table on which was placed a sheet of paper with 16 half-inch circles printed on it arranged in the shape of a square. Under the paper was a pad to facilitate the punching of holes. Three types of procedure were used. In one no suggestion was given. The experimenter said, "Take this puncher and make one hole in each circle like this. Make just one hole in every single circle," illustrating by punching 2 holes in a similar sheet with a sharp pointed stylus. The stylus was then handed to the child with the words, "Now you do it." Time was recorded with a

stop watch from the moment of making the first hole to that of making the last. The 2 other procedures were similar except that in one the experimenter punched all the holes first at a rapid rate, taking about 8 seconds, and in the other at a slow rate, taking about 25 to 30 seconds. The experiment was repeated three times each a week apart with a different type of procedure at each sitting. The order of giving the three methods was varied with the different subjects so that the effect of practice would be minimized. Twenty-four children ranging in age from 4:3 to 6:3 took the test.

time. Nor was there a record kept of which hand was employed in punching, sometimes the right and sometimes the left being used. The fact that in spite of these faults in procedure the results were positive, indicated that this test merited further application.

7. Punching, Form B

This modified form attempted to overcome several of the obvious difficulties of Form A. Instead of the 16 half-inch circles printed in the form of a square, 10 were used, placed in a row $\frac{1}{2}$ inch apart on a sheet of paper $4\frac{1}{2}$ by 11 inches in size (fig. 1). The fact that



FIG. 1. PUNCHING SHEET

The results showed a significant difference between the speed of reaction under the various types of suggestion, average time under slow being 25.3 seconds, under fast 20.5 seconds, and under no suggestion, 24.0 seconds. Of the 24 subjects, 19 punched faster under the fast than under the slow suggestion. These results appeared in spite of several sources of error. The arrangement of the circles in the shape of a square resulted in various orders of punching being used. Many of the younger children used no regular order, or varied their method from time to

they were in a straight line did away with the element of order of punching except with the very youngest subjects. The experimenter demonstrated beginning at the child's left and most of the children imitated this method. Another source of error was eliminated in having all the children use the right hand throughout so that there were no variations in this respect from one period to another. To introduce variety and to maintain the children's interest 2 other types of punching sheet were designed. One-half inch squares and triangles were used in

addition to the circles. Few of the children seemed to be affected by this difference. Aside from these changes the procedure was the same as in Form A.

Nineteen children from 3:6 to 5:4 years of age completed this test. The results show a difference of 5.6 seconds in the average time under slow and under fast suggestion: fast, 13.9 seconds; slow, 19.6 seconds; no suggestion, 19.3 seconds. Of the 19 subjects, 16 punched faster under fast suggestion than under slow suggestion.

8. Marking dog

The final test devised was one in which the suggestion was of a more obvious nature than in the preceding experiments, and is more closely akin to imitation as ordinarily conceived. Here again 3 types of procedure were used. These were designated by the letters F, S, and N to correspond with the Fast, Slow, and No suggestion of the punching test.

N procedure (no suggestion). A sheet of paper $4\frac{1}{2}$ by 11 inches in size with an outline picture of a dog in the center (fig. 2) was placed in front of the child with the words, "Do you see this doggie? Make a mark on the paper at the side of the doggie." The experimenter then placed a crayon in the child's right hand. When the mark had been made she said, "That's good. Now make a mark on the other side of the doggie." A record was kept of the direction in which the line was drawn.

F procedure ("far" suggestion). The picture of the dog was placed in front of the child as before with the words, "Do you see this doggie? I'm going to make a mark on the paper at the

side of the doggie." The experimenter then made a vertical line about $1\frac{1}{2}$ centimeters long, 1 centimeter from the right hand margin of the sheet, and half way between the top and bottom margins. The sheet was then removed exposing a similar one beneath it. The experimenter directed, "Now you make a mark on the paper at the side of that doggie," giving the child a crayon. When he had complied she placed the first sheet again before the



FIG. 2. MARKING SHEET, PRELIMINARY TEST

child and repeated, "Now I'm going to make a mark on the other side of the doggie," making a line at the margin of the paper to the left of the dog. This sheet was again removed and the child told, "Now you make a mark on the other side of that doggie."

S procedure ("short" suggestion). This was similar to the F procedure except that instead of making the mark at the margin of the paper the experimenter drew it one centimeter from the side of the dog.

The distance of the child's marks from each side of the dog was measured in centimeters and the two added. Twenty-nine children from 2:1 to 4:9 years of age took the test. Several did not complete the series, and 5 of the younger ones merely scribbled, so that the data from only 18 are considered. The subjects were divided into 2 groups equated as nearly as possible on the basis of age and sex. Six test periods were used, at least six days apart. N procedure was used at the first and last of these periods for both groups. One group was tested by the F procedure at the second and fourth periods, and by the S procedure at the third and fifth periods. In the other group this order was reversed.

The results show a marked difference in the average distance of the mark made with the 2 types of example: F procedure, 9.4, centimeters, S procedure, 2.7 centimeters; N procedure, 4.1 centimeters. Of the 18 children, 16 showed greater distance under F than under S suggestion. There were, however, striking individual differences between the reactions of the children. Some totally disregarded the suggestions, others followed them exactly. A third group were erratic in their acceptance or rejection.

The sources of error in this test were the irregularity in outline of the dog, which made the measurement of distance somewhat inaccurate, and the fact that it was not always in the exact center of the page. These two difficulties were eliminated in the final form of the test, used in the major study.

EXPERIMENTAL METHODS

Subjects

The subjects used were drawn from four different sources, 31 from the Child Institute of the Johns Hopkins Psychology Department, 83 from the kindergarten and first grade of two private schools, and 22 from the nursery school of a recreation center. All came from distinctly superior homes except the last group which were from a poor district.

In all 136 children took the tests. The oldest was 7:5, the youngest 1:11 years old. Age is reckoned to the nearest month on the day the first test was given. The subjects were divided into two experimental groups, A and B, and a control group, C. Table 1 shows the age and sex distribution of the subjects completing the two tests.

Schedule of testing

Each child was tested six times with approximately a week between each test. In a few cases this was shortened to six days because of a change in schedule. Absences of the children caused by illness, vacations, and quarantines lengthened the period between tests to more than a week in some cases. Table 2 shows the number of cases in which this occurred. All of the testing took place between the hours of 9 and 11 in the morning.

The three types of procedure were given in a different order to the children in the three groups. No suggestion was used for all of the children in the first and last test periods. Group A was tested with fast or F

suggestion at the second and fourth test periods, and by the slow or S at the third and fifth. In group B this order was reversed. The control

ing, Form B. The punching form with 10 circles printed in a row was used (fig. 1) with the 3 types of instructions: fast, in which the experimenter

TABLE 1
Age and sex distribution of subjects completing tests
The 3 year age group includes those from 2:7 to 3:6 inclusive

	AGE					AVERAGE	BOYS	GIRLS	TOTAL
	3 years	4 years	5 years	6 years	7 years				
Punching Test:									
Group A.....	1	10	9	13	7	5 years 4 months 29 days	19	21	40
Group B.....	2	10	12	17	6	5 years 3 months 23 days	24	17	41
Group C.....	1	4	12	3	0	4 years 10 months 24 days	13	7	20
Total.....	4	24	32	28	13		56	45	101
Marking Test:									
Group A.....	2	6	11	13	7	5 years 5 months 13 days	19	20	39
Group B.....	3	11	15	11	6	5 years 2 months 9 days	27	19	46
Group C.....	2	5	12	3	0	4 years 4 months 15 days	14	8	22
Total.....	7	22	38	27	13		64	43	107

TABLE 2
Time intervening between first and last test periods
5- indicates 5 or 5 and a fraction weeks

	5- WEEKS	6- WEEKS	7- WEEKS	8- WEEKS	9- WEEKS	TOTAL
Punching Test:						
Group A.....	25	11	3	1	0	40
Group B.....	20	14	6	1	0	41
Group C.....	4	6	5	4	1	20
Total.....	49	31	14	6	1	101
Marking Test:						
Group A.....	20	15	3	1	0	39
Group B.....	18	18	9	1	0	46
Group C.....	5	6	6	4	1	22
Total.....	43	39	18	6	1	107

group, C, received no suggestion throughout.

Punching Test

The procedure in this test was identical with that of the preliminary punch-

demonstrated by punching the 10 holes in 5 seconds; slow, in which they were punched in 20 seconds; and no suggestion, where only two of the holes were punched. A slight variation in method was made for the C

group who were tested without suggestion throughout. After the first test period the experimenter did not punch any of the holes but merely gave the verbal instructions.

The children's behavior in the test situation was interesting. All of them seemed to enjoy this test. Several of those in the first grade remarked upon its being too easy and became rather bored by the sixth trial, but none refused to do what was desired. They were often impatient to start and would say, "I know how," trying to take the stylus before the experimenter had time to complete her demonstration. Sometimes as they watched they would make rhythmic motions in time with her movements, nodding the head or swaying the whole body a little.

There were several unavoidable sources of error in the procedure. One has been mentioned in the problem of the use of the right or left hand. In addition the method of holding the stylus and of punching varied greatly. Some children would punch lightly, making small holes, others very deeply, pushing the stylus completely through the pad to the table top. Another difficulty met with especially in the younger children was irregular order of punching. Finally, several of the children had the tendency to stop and talk during the test. If any of these disturbing elements entered in too marked a degree, timing became inaccurate and the test is classed as not completed. This took place in only 5 subjects above 3 years of age, but in practically all below that age.

Marking Test

The procedure used was identical with that in the preliminary marking

test except that a picture of a house (fig. 3) was substituted for that of the dog, and the word "house" used in the instructions in the place of "doggie." On the whole this test did not interest the children as much as the punching. Several asked for a more difficult task. There was a compensating advantage in the simplicity of the reaction since younger children were able to do it successfully than could do the punching. There was one factor introducing error. In several cases a child would



FIG. 3. MARKING SHEET

not wait for the second instruction before making his second mark, thus only one visual suggestion was given instead of the usual two. The results show that this is not as significant as first appears, since the right and left hand marks were in general remarkably symmetrical in their distance from the house.

TREATMENT OF DATA

Group results, Punching Test

The number of seconds taken to punch the ten holes constitutes each

day's score in this test. Table 3 shows the mean scores for each group. Detailed tables giving individual results are in a dissertation on file in the library of the Johns Hopkins University. The influence of suggestion is clearly perceptible in the group averages. For example the scores of Group A fluctuate from 16 to 12 seconds in accordance with the type of suggestion. This difference is made clear by comparing the sum of the two average scores under F suggestion with the sum of the 2 under S suggestion, and also with the scores when no suggestion is given. The

ence is 6 and 6.4 seconds respectively or 20 and 22 per cent of the N reaction. The factor of practice effect is one which needs to be considered. If it existed to any large extent it would increase the difference between the F and S reactions in the B Group where the slower suggestion comes first, and decrease this difference in the A Group where the faster comes first. The average punching time in the six consecutive trials of the A and B Groups was as follows: 16.2 seconds, 14.3 seconds, 14.5 seconds, 13.7 seconds, 13.3 seconds, 13.2 seconds. The effect

TABLE 3
Mean scores of the three groups

	NUM- BER OF CASES	TRIAL 1	TRIAL 2	TRIAL 3	TRIAL 4	TRIAL 5	TRIAL 6	F	S	N	DIFFERENCE BETWEEN F AND S
Punching Test:											
Group A.....	40	16.3	12.3	16.3	12.8	14.8	13.9	25.1	31.1	30.2	6.0 ± .69
Group B.....	41	16.0	16.2	12.6	14.5	11.7	12.5	24.3	30.7	28.4	6.4 ± .84
Group C.....	20	16.9	16.2	15.5	14.3	14.9	15.1	30.5	30.4	32.0	.1
Marking Test:											
Group A.....	39	3.2	13.6	2.7	12.8	4.1	4.9	26.4	6.8	8.1	19.6 ± 1.35
Group B.....	46	2.2	1.9	11.1	3.1	11.5	5.2	22.6	4.9	7.4	17.7 ± 1.37
Group C.....	22	1.8	1.6	1.8	1.5	1.4	1.5	3.1	3.2	3.3	.1

last column of table 3 shows this difference and its probable error. As a check the results from Group C, where no suggestion was given, are treated as those in the A Group; that is, the first and sixth trials are classed under N, the second and fourth under F, and the third and fifth under S. This demonstrates clearly that the type of suggestion given had a definite effect upon the children's reactions. In the C Group the difference between the F and S scores is only one-tenth of a second, or .3 per cent of the N reaction, while in the A and B Groups the differ-

ence of practice was small except in the first trial where the task was new to the children. This demonstrates the wisdom of giving a preliminary trial to accustom the children to the test situation, even though the reaction required of them may be very simple. The mean time, of six trials, taken by each child to punch the 10 holes varied from 8 to 25 seconds. Age seemed to have some influence on this general speed of reaction, though not as great difference was found between the 4 and 7 year old reactions as between the F and S. Table 4 gives these

results. The smallness of the age groups permits only the generalization that there seems to be a tendency toward greater speed of reaction with increasing age.

Group results, Marking Test

The children's reactions in the Marking Test were scored by measuring in centimeters the horizontal distance from their mark to the side of the house. Variations in type of mark introduced some difficulties. These were eliminated by establishing the rule that the measurement should be made from the point where the child

93 per cent of the cases in the A and B Groups, and in 100 per cent in the C Group.

The influence of suggestion is even more marked than in the Punching Test. Table 3 shows the mean scores of the three groups. It is possible to pick out the trials where F suggestion was given by the large size of the score. The delayed influence of suggestion appears here quite clearly in the sixth score of the A and B Groups which is about twice as large as the first score although both were under no suggestion. In the C Group there was no possibility of delayed suggestion and

TABLE 4
Age differences in time scores of the punching test
Means of individual scores given in seconds

	AGE				
	3 years	4 years	5 years	6 years	7 years
Group A.....	19.1	17.6	14.7	12.1	12.7
Group B.....	14.2	16.1	13.4	13.2	12.2
Group C.....	23.1	16.6	15.0	13.4	

first touched the crayon to paper. In cases where this point was so near the top of the sheet that a horizontal line would strike the roof instead of the side of the house, measurement was made as though the side extended vertically to the top of the paper.

Daily scores were obtained by adding the distances of the right and left hand marks. This obscures the factor of symmetry between the distances at the right and left sides of the picture. On the whole the children were remarkably consistent in the reactions on the two sides. There was less than 3 centimeters difference between the two in

the first and last scores are practically identical. The sum of the two F, S, and N reactions makes the effect of suggestion even clearer. This also appears in table 3. Here again the results from Group C are treated as those in Group A. The difference between the F and S scores in the C Group is 3 per cent of the N reaction, and in the A and B Groups 41 and 42 per cent respectively.

Suggestibility scores

From the four daily scores of each child under the F and S suggestion a suggestibility score was computed for

each test. In the Marking Test this consisted of the difference between the sum of the two scores under F suggestion and the sum of the two under S. So if a child drew his mark close to the house when the suggestion was close, and far from it when the suggestion was far, his suggestibility score would be high, denoting positive suggestion. If he paid no attention to the sugges-

ference between the scores under F and S suggestion was not an accurate measure of suggestibility because it did not take into account the factor of variations in the speed of punching from child to child. One who was slow in all his reactions would have a proportionally larger difference between those under F and S, and his suggestibility score would be weighted to that

TABLE 5
Distribution of suggestibility scores in the punching test
Score .60 includes values from .60 through .69

	SCORE																	
	.60	.70	.80	.90	1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70	1.80	1.90	2.00	2.10	2.20	2.30
Group A.....	1	0	2	1	10	5	6	4	2	4	0	2	0	1	1	0	0	1
Group B.....	1	0	2	3	5	7	3	1	5	2	6	2	2	1	0	1	0	0
Group C.....	1	0	3	2	9	4	1	0	0	0	0	0	0	0	0	0	0	0
Groups A and B.....	2	0	4	4	15	12	9	5	7	6	6	4	2	2	1	1	0	1

TABLE 6
Distribution of suggestibility scores in the marking test
Score 4 includes values from 4 through 7.9

	SCORE										
	- 4	0	4	8	12	16	20	24	28	32	36
Group A.....	2	5	2	4	2	2	6	4	4	4	4
Group B.....	2	11	3	4	3	4	0	2	6	6	5
Group C.....	6	15	0	0	0	0	0	0	0	0	0
Groups A and B.....	4	16	5	8	5	6	6	6	10	10	9

tion but marked in the same place throughout, the score would be zero denoting no suggestibility. And finally if he marked near when the suggestion was far, and far when it was near, the score would be a negative quantity, denoting negative suggestibility. There were few of this latter type.

In the Punching Test the simple dif-

ference between the scores under F and S suggestion was not an accurate measure of suggestibility because it did not take into account the factor of variations in the speed of punching from child to child. One who was slow in all his reactions would have a proportionally larger difference between those under F and S, and his suggestibility score would be weighted to that

Therefore the suggestibility score in punching is the ratio between the sum of the two daily scores under slow sug-

gestion and the sum of the two daily scores under fast suggestion. A score above one means positive suggestibility, below one negative suggestibility, and unity means that suggestion has no effect. In comparing the suggestibility scores of the two tests a zero score in Marking is equivalent to a unity score in Punching.

The average suggestibility scores of the 3 groups were as follows: Punching Test, Group A, $1.28 \pm .04$, Group B $1.33 \pm .04$, Group C 1.00; Marking Test, Group A 19.6 ± 1.35 , Group B 17.7 ± 1.37 , Group C 0.1. The difference in score between the experimental and control groups is quite marked and several times the size of the probable error. The distribution of suggestibility scores, shown in tables 5 and 6 makes this difference even more clear. We see that a large majority of the scores fall above that point denoting no suggestion. There are very few that show negative suggestibility. The distributions of the A and B Groups are quite similar throughout in contrast with the C Group where the scores are closely grouped around the point of no suggestion.

Combining the distributions of the A and B Groups gives an interesting contrast between the two tests (fig. 4). Both have a mode corresponding to the score denoting lack of either positive or negative suggestion. The Punching Test gives a skewed unimodal distribution, with more cases showing positive than negative suggestion. The Marking Test has a bimodal curve, one mode appearing at the point of no suggestibility and a second smaller one at high suggestibility. These two types of curve are

similar to those which Estabrooks (9) attributed to emotional and non-emotional situations, and identified with Aveling and Hargreaves' (1) "Prestige and Non-prestige" tests. The U-type of curve supposedly appears when prestige or emotion are present. The factor of prestige certainly entered equally into both Punching and Mark-

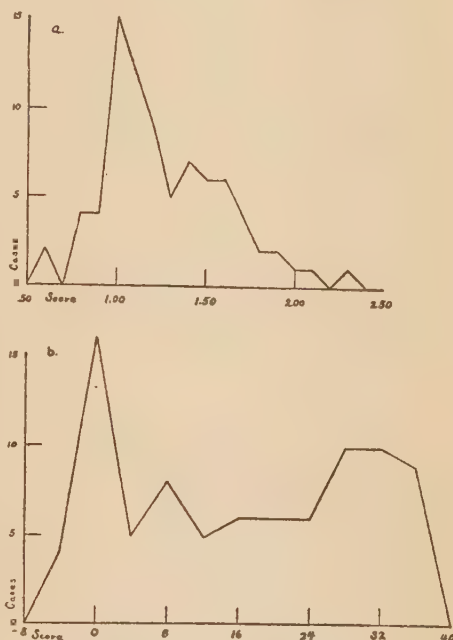


FIG. 4. DISTRIBUTION OF SUGGESTIBILITY SCORES

a, Punching Test; b, Marking Test

ing, for the same experimenter demonstrated in both. Nor does emotion appear to be significant. If anything, greater emotion would appear in the Punching Test, which was a more novel situation and a more difficult task, than in the Marking Test, yet the latter has the supposedly emotional type of curve.

Two possible explanations of this difference in the distribution of scores are the relative obviousness of the suggestions in the two tests, and the relative ease of following them. Perception of distance is probably a more simple reaction than perception of speed, making the Punching Test suggestion more difficult to follow. In addition the suggestion in the Marking Test was more obvious because it was before the child while he was reacting, while in the Punching Test it was already merely a memory. The second factor accounting for higher suggestibility in the Marking Test is the ease of following the suggestion. Any child could make his mark near or far from the house, but not any child could follow the fast speed of punching. Especially were the younger ones thus handicapped.

Individual reaction curves

An analysis of the curves representing the six consecutive daily reactions of each child reveals many interesting variations. Figures 5 and 6 show typical curves in relation to the suggestions which were given. Since the type of measurement in the two tests was different, the curves resulting cannot be compared directly, and a separate analysis of each is necessary.

Punching Test. It was difficult to classify the individual reaction curves of the Punching Test into types owing to the large number of variations present. In some cases the child's reactions followed those of the experimenter fairly closely, for example figure 5 (b), representing the reactions of a child in Group A, is of the same form as figure 5 (a), representing the experi-

menter's reactions in giving the suggestions to that group. Dotted lines connect those points representing reactions where no suggestion was given. Figures 5 (c) and (d) illustrate the experimenter's and a child's reactions in Group B. Both of these children were highly susceptible to suggestion

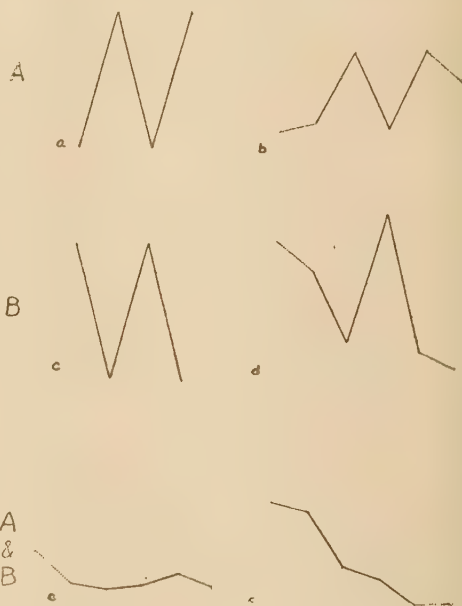


FIG. 5. INDIVIDUAL REACTION CURVES, PUNCHING TEST

a, suggestions given to Group A; b, fluctuating curve of Group A; c, suggestions given to Group B; d, fluctuating curve of Group B; e, level curve; f, practice curve

and received a high suggestibility score. There are cases, however, of children receiving a high score whose curve was not as typical as these.

In contrast to those curves which demonstrate the effect of suggestion we find some which are fairly level, figure 5 (e), and others which are in the form of a typical practice curve, figure

5 (f). These two types represent low suggestibility. Each type is not distinct from the others but grades into them by imperceptible degrees. It is necessary to make some arbitrary definition of the limits of each, as follows:

1. Fluctuating Type, more than six seconds difference between the highest and lowest records (fig. 5(b) and 5 (d)).
2. Level Type, not more than six seconds difference between the highest and lowest records (fig. 5 (e)).
3. Practice Type, more than six seconds drop from the first to the last record, and not more than a two second rise at any one point (fig. 5 (f)).

Group B is easily explicable, since the order of giving the suggestions, slow then fast, would facilitate the practice effect more than the fast-slow order given to the A Group.

Marking Test. It is possible to distinguish types much more definitely in the Marking Test than in Punching. The following are rather sharply differentiated from each other:

1. "M" Type, in which the reactions follow the suggestions almost exactly, forming an M-shaped curve. Figure 6 (b) represents this type of reaction in the A Group following the suggested reactions shown in figure 6 (a).

TABLE 7
Distribution of curve types in the punching test

	GROUP A	GROUP B	GROUP C
Fluctuating Type:			
Score above 1.50.....	9	11	0
Score 1.20 to 1.50.....	10	8	1
Score below 1.20.....	7	6	9
Total.....	26	25	10
Level Type.....	12	11	7
Practice Type.....	2	5	3

The frequency of these types is given in table 7. The distribution in the A and B groups is similar. About two-thirds of the curves are of the fluctuating type. The rest are fairly level. In the C group where no suggestion was given the proportion of irregular curves is lower, being exactly one-half. But even here there were individuals who were as variable in their reactions as some who were given suggestions. In all three groups the number of practice curves is small, showing that the reaction was one so simple that not much improvement occurred. The larger number of curves of this type in

Figures 6 (c) and 6 (d) represent the same for Group B.

2. "V" Type, in which the F suggestion is followed only once, forming a level line with only one pronounced peak, like an inverted V. Figure 6 (e) is an example of this type of curve in the B Group. Similar curves occurred in the A Group, with the peak at other points.
3. Delayed Type, in which the F suggestion is effective on trials where it is not given. An example of this curve in the B Group is given in figure 6 (g). It occurred also in the A Group.
4. Level Type, where there is no evidence of the effect of suggestion. This is in sharp contrast to all of the other types. Figure 6 (f) is an example.

It occurred in all three groups and is the only type appearing in Group C where no suggestions were given.

5. Irregular, fluctuating and unclassifiable. Only 2 children exhibited this type.

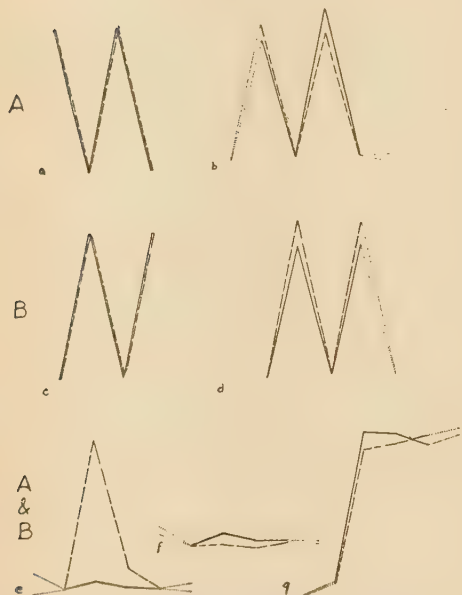


FIG. 6. INDIVIDUAL REACTION CURVES, MARKING TEST

a, suggestions given to Group A; *b*, M Type curve of Group A; *c*, suggestions given to Group B; *d*, M Type curve of Group B; *e*, V Type curve; *f*, level curve; *g*, delayed curve. Unbroken line denotes right side reaction, broken line, left side reactions.

The distribution of each type in the three groups is shown in table 8. Right and left side reactions are both considered and their sum given. Here the contrast of the C Group with the A and B is even more marked than in Punching. Over a third of the children in the first two groups followed the suggestions very closely, and about three-fourths were influenced by them

to some extent. The fact, however, that several curves of the level type were found in both the A and B groups indicates that there were some children on whom the suggestion seemed to have absolutely no effect.

The factor of symmetry is illustrated clearly by figure 6. A majority of the individual curves were as those in figure 6 (*b*), (*d*), (*f*), and (*g*), where the right and left side reactions were placed at symmetrical distances from the picture of the house, and are plotted as practically identical curves. There were some cases, however, where the mark on one side was placed near, the other far. Figure 6 (*e*) illustrates one of this type.

The relation which the suggested reactions bear to the children's initial reactions forms an interesting contrast in the 2 tests. In Punching the S suggestion was sometimes faster and sometimes slower than the child's own reaction when no suggestion was given. If it were slower it often produced an inhibitory effect, slowing down the child's speed, as in figure 5 (*b*). If it were faster it would speed up the reaction, as occurred to a slight extent in figure 5 (*d*). The F suggestion was in all cases faster than the child's initial reaction and so produced speeding up when it was effective.

In the Marking Test on the other hand, the F suggestion was the only one which had any effect in changing the children's reaction. In practically all cases the S suggestion coincided very closely with the child's own reaction when no suggestion was given. Figure 6 illustrates this clearly. All of the initial reactions in the children's curves are near the S distance. This

fact seems to be responsible for the larger number of cases of level curves in the B than in the A Group. In the former the S suggestion was given first. Being similar to the child's own reaction, this suggestion reinforced it and made him impervious to the later F suggestions. In the A Group the F came first and not having so much resistance to overcome was more successful in producing acceptance, so the number of M type curves is larger than in Group B.

The difference between the F and S suggestions was more definite in Marking than in Punching. This may account for the higher suggestibility in

measuring reliability. The tests were divided in two parts and the halves correlated. In Marking this was done by finding the difference between the daily score under F and S suggestion in the second and third daily periods, and the difference in the fourth and fifth. These two scores were then correlated. The coefficients obtained were not high but of some significance, indicating that a child who followed the suggestions in the first part of the experiment was likely to do so in the latter half. They were for the A group $.40 \pm .08$,* and for the B group $.55 \pm .07$.

Fourteen of the children had been given the Marking Test before in prac-

TABLE 8
Distribution of curve types in the marking test

	GROUP A	GROUP B	GROUP C
M Type.....	35	28	0
V Type.....	17	15	0
Delayed Type.....	10	17	0
Level Type.....	14	30	40
Irregular Type.....	2	2	0

Marking and for the fact that the curve types are more distinct here.

Consistency

The problem of an individual's consistency in his acceptance of suggestion is one which has received much consideration. In general the results of previous experimentation indicate that suggestibility is not a persistent trait of personality, but is related to the specific situation. The findings of this study uphold these conclusions.

There were several methods of studying how consistent the children were in their suggestibility. One method was that ordinarily used in

tically identical form, Marking Dog. They formed a group whose consistency could be measured in another way. This was done by correlating the suggestibility scores on the two tests. The coefficient here was again positive, $.35, \pm .16$, but the smallness of the group made the probable error so large that it cannot be considered significant.

Consistency of reaction on the Punching Test was studied in the same way as Marking. A ratio between the first two F and S reactions was com-

* All correlations were computed by the rank order method using Pearsons "Rho" Formula.

puted, similar to the suggestibility score for the whole test, and this was correlated with a ratio obtained from the last two F and S scores. Here the coefficients obtained, though positive, were very low and cannot be considered significant. They were in the A Group $.10 \pm .29$ in the B Group $.30 \pm .17$. From this we infer that the children more suggestible in one part of the Punching Test are not especially likely to be so in the other.

A final method of measuring consistency of response to suggestive

punching there is a positive correlation represented by the coefficient $.47 \pm .09$. This relationship is shown in table 9 which gives the average score for the various age groups. The C group indicates that where no suggestion is present the score does not vary with age. We may therefore conclude that in this test the older children are more suggestible. This is not true in the Marking Test. The coefficient of correlation between age and suggestibility score is not significant, being $.25 \pm .10$. The average scores for the

TABLE 9
Age differences in mean suggestibility scores

	AGE				
	3 years	4 years	5 years	6 years	7 years
Punching Test:					
Group A.....	1.02	1.24	1.22	1.33	1.36
Group B.....	1.10	1.05	1.30	1.53	1.59
Group C.....	.91	1.03	1.01	.97	
Marking Test:					
Group A.....	12.0	17.5	14.1	22.8	26.4
Group B.....	9.4	17.9	17.2	20.2	17.9
Group C.....	-3.1	.4	.2	-.3	

stimuli consisted in correlating the scores of the two tests, Punching and Marking. Here again the coefficient was low with a large probable error, $.12 \pm .11$. We must therefore conclude that suggestibility as here measured is not a persistent trait but one which varies greatly from situation to situation and from time to time in the same situation.

Age and sex differences

The influence of age on suggestibility score is different in the two tests. In

different ages, shown in table 9, indicates this slight tendency towards decreasing score with decreasing age.

The factor of relative difficulty of the two tests may again be used in explanation of this difference between them. The Marking Test would indicate that four year old children are as susceptible to suggestion as those of six and seven, when they can comprehend it and are able to carry it out. In the Punching Test their lack of manual dexterity and perhaps the fact that they do not easily perceive the sugges-

tion, speed of movement, makes them less suggestible than those somewhat older.

No significant sex differences were found. In the Punching Test the difference in score between the boys and girls was in Group A $.13 \pm .07$, in Group B $.08 \pm .07$, the girls being slightly more suggestible. In the Marking Test the boys were more suggestible in Group A by a difference of .9 and the girls in Group B by a difference of 3.4.

SUMMARY

Varying types of experimental situations were used in an endeavor to select some which would give a measure of a child's response to suggestive stimuli. Two coördination tests given with positive and negative instructions gave indications that the negative instructions produced no perceptible effect. Two tests involving drawing were not continued because they measured only acceptance or non-acceptance of suggestion and not the extent of each. A test in which gross bodily movements were involved proved unsatisfactory because of the length of time required for response and the possibility of distraction of the child's attention by other factors.

Two tests were finally adopted for a more extensive study in which visual stimuli acted as suggestions influencing simple hand movements. Measurements of the reactions of 101 children from 3 to 7 years of age under two

opposing types of suggestion showed a definite effect which a control group of 35 children, who were given no suggestions, did not exhibit.

Several conclusions regarding suggestibility may be drawn from the results of this study.

1. Most children are suggestible to a certain degree in one situation or another, although a few appear to be uninfluenced by visual suggestion of the type used. In some suggestion has a delayed effect. Negative suggestibility is rare.

2. Suggestions of two opposing types are accepted successively when a time interval occurs between their presentation. Suggestions which are similar to a child's own method of reaction reinforce his tendency and make opposing suggestions less effective.

3. The extent to which suggestion is followed depends on the obviousness of the suggestion and the ease of performing the movements which it involves.

4. Children are not consistent in their acceptance or rejection of suggestion. In repetition of identical situations there is some probability that they will react in the same way, but this is not true if a time interval of more than a few weeks intervenes. Individual suggestibility in one type of situation seems to bear no relation to that in another.

5. Suggestibility increases slightly with age in the age range here considered. No sex differences are apparent.

REFERENCES

- (1) AVELING, F., AND HARGREAVES, H. L.: Suggestibility with and without prestige in school children. *Brit. J. Psychol.*, 1921, **12**, 53-75.
- (2) BAUDOUIN, C.: Suggestion and auto-suggestion. (Trans. by E. and C. Paul) N. Y., 1921.
- (3) BELL, J. C.: The effect of suggestion on the reproduction of triangles and point distances. *Am. J. Psychol.*, 1908, **9**, 504-518.
- (4) BINET, A.: La suggestibilité. Paris, 1900.
- (5) BINET, A., AND SIMON, TH.: Des enfants normaux et anormaux. *Annee Psychol.*, 1905, **11**, 274.
- (6) BRAND, J. D.: The effect of verbal suggestion upon the estimation of linear magnitudes, *Psychol. Rev.*, 1905, **12**, 41-49.
- (7) BRIDGES, K. M. B.: Some observations on contrariness or negativism. *Ment. Hyg.*, 1925, **9**, 521-527.
- (8) DUNLAP, K.: Social psychology. Baltimore, 1925.
- (9) ESTABROOKS, G. H.: Experimental studies in suggestion. *Ped. Sem.*, 1929, **36**, 120-139.
- (10) GIROUD, A.: La suggestibilité chez des enfants d'école de sept à douze ans. *Annee Psychol.*, 1912, **18**, 362-388.
- (11) HARTENBURG, P.: Die zwei Hauptformen der Suggestibilität. *Zsch. f. Psychother. u. Psychol.*, 1910, **2**, 44-47.
- (12) HILGER: *Über Suggestion*. *Zsch. f. Psychother. U. med. Psychol.*, 1914, **6**, 65.
- (13) HUMPHREY, G.: Imitation and the conditioned reflex. *Ped. Sem.*, 1921, **28**, 1-21.
- (14) JASTROW, J.: A study of involuntary movements. *Am. J. Psychol.*, 1892, **4**, 398-407, **5**, 223-231.
- (15) JOHNSON, B. J.: Mental growth of children in relation to rate of growth in bodily development. N. Y., 1925.
- (16) JONES, G. M.: Experiments on the reproduction of distance as influenced by suggestions of ability and inability. *Psychol. Rev.*, 1910, **17**, 269-278.
- (17) LADD, G. T., AND WOODWORTH, R. S.: Elements of physiological psychology. N. Y., 1911.
- (18) LANGFELD, H. S.: Voluntary movements under positive and negative instructions. *Psychol. Rev.*, 1913, **20**, 459-478.
- (19) LEVY, D. M., AND TULCHIN, S. H.: The resistance of infants and children during mental tests. *J. Exper. Psychol.*, 1923, **6**, 304-322.
- (20) LEVY, D. M., AND TULCHIN, S. H.: The resistant behavior of infants and children, II. *J. Exp. Psychol.*, 1925, **8**, 209-224.
- (21) LEVY, D. M.: Resistant behavior of children. *Amer. J. Psychiat.* 1925, **4**, 503-507.
- (22) MACDOUGALL, R.: Contrary suggestion. *J. Abn. Psychol.*, 1912, **6**, 368.
- (23) MACDOUGALL, W.: An introduction to social psychology. Boston, 1921.
- (24) MORGAN, J. J. B.: The nature of suggestibility. *Psychol. Rev.*, 1924, **31**, 463-477.
- (25) MOSSE, K.: *Über Suggestion und Suggestionstherapie im Kindesalter*. *Zsch. f. Kinderforsch.*, 1922, **27**, 65-78.
- (26) OTIS, M.: A study of suggestibility of children. *Arch. of Psychol.*, 1924, No. 70.
- (27) PEARCE, H. J.: Experimental observations upon normal motor suggestibility. *Psychol. Rev.*, 1902, **9**, 329-356.
- (28) REYNOLDS, M. M.: Negativism of pre-school children. *Teachers College Contributions to Education*, No. 288, 1928.
- (29) SHERMAN, I. C.: The suggestibility of normal and mentally defective children. *Comp. Psychol. Mon.*, 1924, **2**, No. 9, pps. 44.
- (30) SIMON, TH.: *Experiences de suggestion sur des débilés*. *Annee Psychol.*, 1899, **5**, 441-484.
- (31) SMITH, W. G., AND SOWTON, S. C. M.: Observations on spatial contract and confluence in visual perception. *Brit. J. Psychol.*, 1907, **2**, 196-219.

- (32) SOLOMONS, L. M., AND STEINS, G.: Normal motor automatisms. *Psychol. Rev.*, 1896, **3**, 492-512.
- (33) STARCH, D.: Unconscious imitation in handwriting. *Psychol. Rev.*, 1911, **18**, 223-228.
- (34) STRONG, E. K.: The effect of various types of suggestion upon muscular activity. *Psychol. Rev.*, 1910, **17**, 279-293.
- (35) THOMAS, D. S. (Ed.): Some new techniques for studying social behavior, Chapter VII by Nelson, J. F., Preliminary report on some uses of the psychological test situation for studying personality differences. *Child Dev. Mon. No. 1*, Teachers College, Columbia Univ., 1929.
- (36) TUCKER, M. A.: Comparative observations on the involuntary movements of adults and children. *Amer. J. Psychol.*, 1896, **8**, 394-404.
- (37) WELLMAN, B.: The development of motor coordination in young children. *Univ. of Iowa Studies in Child Welfare*, **3**, No. 4, 1926.
- (38) WHIPPLE, G. M.: *Manual of mental and physical tests*, Part II. Baltimore, 1915.

VITA

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